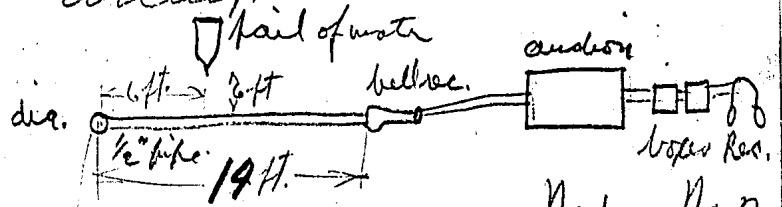
Notebook Series -- Notebooks by Edison
Notebook, N-18-07-02

This notebook was used during July 1918. Most of the entries are by Edison, but there are also some by John A. Hanley. Many of these notes were made in the garage at Glenmont, Edison's home in Llewellyn Park, New Jersey, where he was working with Hanley, William A. Hayes, and probably James M. Burns on a series of experiments pertaining to the measurement and detection of sound under water in connection with work for the U.S. Navy during World War I. Included are tests with various devices used to pick up and amplify the sound of dripping or flowing water, possibly as a way of compensating for the interference experienced in listening to a sound detection device as it was towed behind a moving vessel. Among the components employed are long brass and rubber tubes, telephone receivers, and audions. The experiments are continued in N-18-07-11. The front cover is marked "No 1" and "Moore" and is labeled "War." The pages are unnumbered. Approximately 120 pages have been used.

MFG. STATIONERS,
66 JOHN ST.
AND
15 PIATT ST.
NEW YORK.

Book 1 July 2/18.

Test No 1.
Dropped water from height of 6 ft (calculated velocity 10 knots per hour) 6 ft from diaphram, on ½" brass tubing.
Listening through 3 stage audion.
Lines were taped in circuit.



	No 1.	No 2.
Hayes lost at	63	69
Hanley " "	70	70
Burke " "	54	60

Reversed Telephone on 2nd

1/32 walls ½" inside diam

Test
No 2. Increased length of ½" brass pipe from 14 ft to 28 ft.

	No 1.	No 2.
Hayes head over	71	71
Hanley " "	71	71
Burns " "	71	71

Test No 3.

Dropped water on piece of tin at angle of 45°, 4 ft. from diaphram.
28 ft tubing same as test No 2.

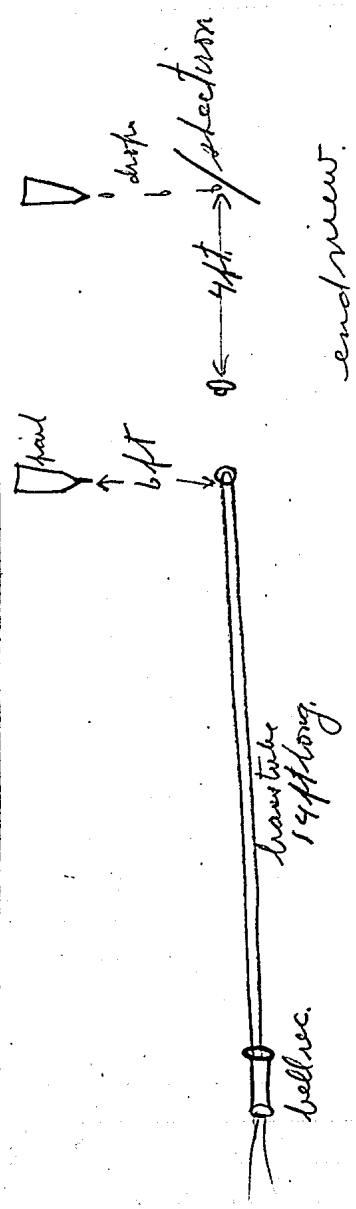
Hayes	40
Hanley	42
Burns.	36

Test No 4.
Same as No 3 except 14 ft. length of tubing instead of 28 ft.

Hayes	42
Hanley	42
Burns.	38

Cat No 5.
Removed mica diaphram from tube and plugged up hole with cork.

Hayes 6
Henley. 4
Burns. nil



Like this.

July 3. 18.

Comparative readings of 3 and 4 stage audions

No 1. 14 ft brass tubing with mica diaphram.
Water dropping at a height of 6 ft. on sheet iron at 45° angle. 4 ft away from diaphram.

3 stage

Hayes	42
Hanley	42
Burns.	

4 stage

Hayes	64
Hanley	67
Burns.	

Note something apparently wrong with 4th stage in audion.

3 stage

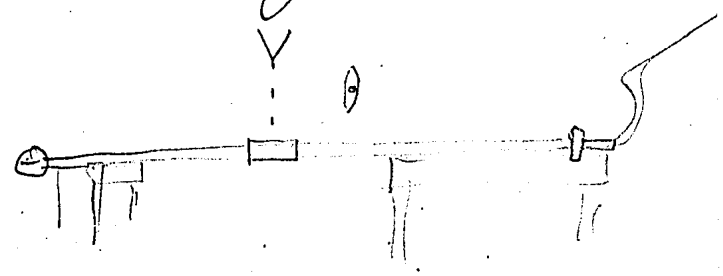
No 2,

Water dropping on stream line form tin covered with rubber,

stuffed with cow hair around glass tube.

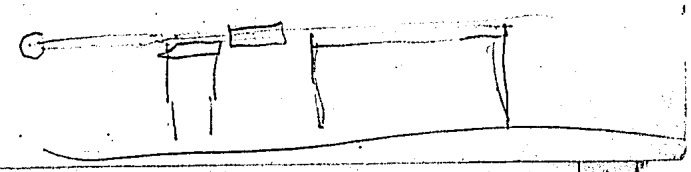
drops is 6 ft. away from diaphram.

~~Hanley~~	~~48~~
Hanley.	46



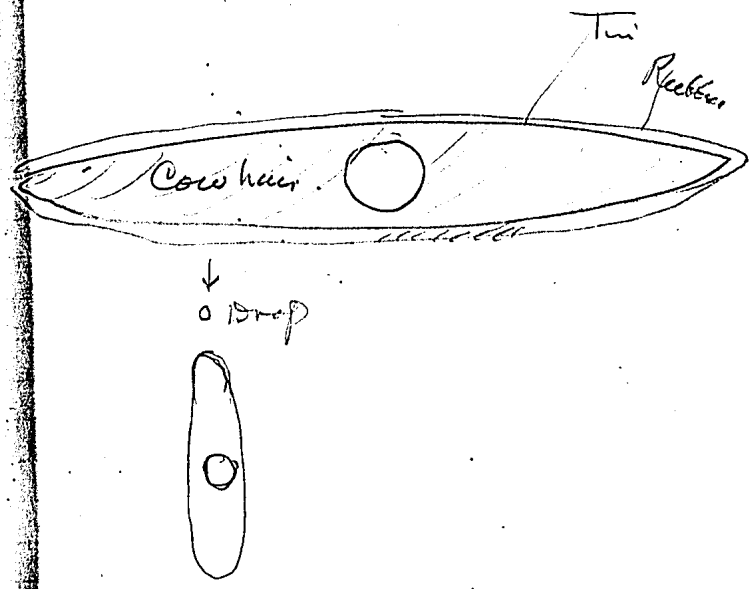
Support too far. Thick drop sliding caused rod vibrate & made sound

put it nearer



3 Stage
Thermakes it louder

Hayes 61 on book
Hanley 61



We now take off diaphram
plug tube with a Cork

3 stage

Thinking the drop jaw tube &
this starts diaphgm.

Hayes 46-
Hanly 52

Shows some of sound Came from
Diaphm -

We now drop water right on
brass tube while plugged

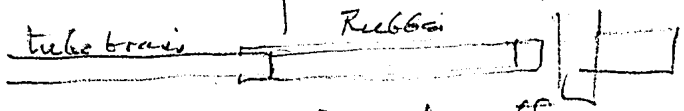
Hayes 60-
Hanly 58

Possibly the sound is
Conducted to phone Item

3 stage Induction

the metallic pipe not through air at all —

We now put in of rubber tubing 4 ft long



pipe is plugged at other end

Hayes 38
Hanley 48

We now shorten the Rubber tube to 6 inches as too large as loss by friction with 4 ft. of rubber tubing connecting to phone

Hayes 54
Hanly 58

3 Stage

Now with the 6" rubber tubing connecting phone to pipe we drop the water on the rubber to determine how much less is the sound than dropping water direct on the brass pipe (Tube end plugged)

Hayes 38

Hanley 38

3 Stange -

Stange we got it too strong through the rubber & through Cow hair to brass tube - We now let it drop into pan + not touching pipe this makes considerable sound + we may hear it in tube with the phone at one end

Hayes Nothing
Hanly Nothing

3 Stage

We now know the drop distinct to tube by Conduction throw rubber, tin + Cow hair to tube + that acts as a diaphragm of some kind

We now take out Cow hair + pack it in very loose as it was packed tight before

Hayes — 28

Hanley 26 -

Dropping on tube

3 stage –

The chaos sound was
Conducted through the
Cow hair as a mass –
not through air interstices

We have been dropping
the water on Edge of
others

We now drop it on middle
with same conditions of
last Experiment, loose Cow hair

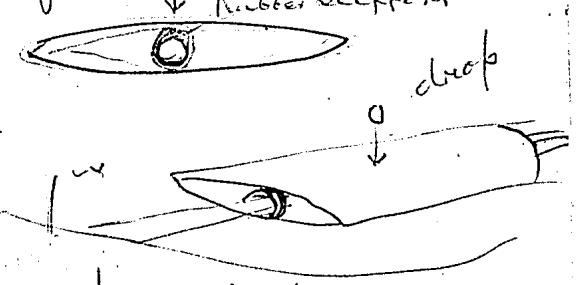
Hayes 38.
Hanly 38.

~~By mistake this was dropped on Edge~~

3 Stage

We now take out cocohair + support tube by rubber at each end of ⬭ only contact from tube to boat is through the 2 rubber supports at each end of boat;

We continue to drop on wide part of boat (drop)



Hayes | 28
Hanley 24-

3 slaïque

We now drop the Experiment on last page & drop it on float of Coat,

Hayes	46.
Hanley	48

Evidently rubber at both Ends not so good as Lace Cowhair

Note =

Wool is better than Cowhair
it more Elastic + finer
if we get the right kind
+ prevents it shape a
donut pack —

Rubber Sponge might
answer,

3 Plaque -

Dropping on Edge —

We take out a rid rubber
Dumpoils at each end
of Coat + hold by
Elastics of rubber
Hayes 4 ? ?
Hanly 2

There are 2 Elastic bands
on each side holding it
up -

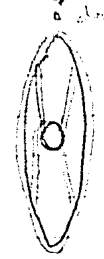
This is fine result but

Note, Apparently the 1/32 walls of our tube is acting as a diaphragm — We may have to use 1/16 or even 1/8 walls.

3rd Class

The Elastics are too small to practically keep pipe central in practice, only ordinary 1/16 thin Elastics.

We now use 3/16 only thin wall 1/32 wall rubber tubing for suspension

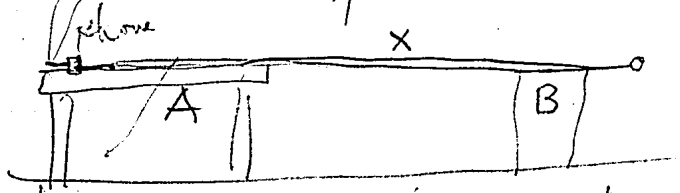


Hayes 6
Hanley 4

July 5 1918 –
3 Stage,

We are now on the Concrete garage at the house, using small room next to large one for Audion & listening – Bagdad says it is very quiet even ignore quiet that of Otto room at Kaa nights, as mr Tom & Trolley bother there,

Expt A



Band on Cow horn Z.[illegible] Knock out A + B – Diaphm end of Tube plugged – Water drop falls 6 ft on Tube at X

Hayes 43
Hanley 37

Rubber tube not used in commonly phone to Tube

3 stage July 5 1918

Expt B

We have Connected phone to tube then 6" of Rubber Tubing -

Hayes
Hawley
New Boy ng -

above 60

BWD

The reason we get such high results is due to being very quiet in garage -

We now put a bench under tube where the water drops rolling on soft Rubber this tends to prevent drop from bending tube

3 stage —

We disconnected phone before supporting it on rubber where drop falls + put in ear tubes —
The sound was much louder direct than thru phone + audion.
Showing that direct listening is much more sensitive than phones + audion
It should be used where it is possible as to simplicity itself —
The only way an audion could be

it would be to use a Microphone instead of a Bell phone to receive the sound then a tube to amplify thus by an audion. This would undoubtedly beat direct listening & micro need not be the sensitive one to try

---

Expt C

We now try support of tube on rubber, & have water nuts –

No difference

Expt D

We take out support & put in a plugged tube with walls $\frac{1}{16}$ thick, at same time the water drop falls 3 ft instead of 6 ft as 6 ft gives over 60 on boxes –

Hayes
Hanley – Hear 60 –

July 5/1918

Expt E

Same conditions as D but water drops 2 ft

1/16 wall tube
show 6" [illegible]

Hayes
Hanley - Hear to 60

Expt F We now let water drop 6 inches plugged

Hayes 36
Hanley 38

Expt G

Same as F but $\frac{1}{32}$ wall old pipe substituted

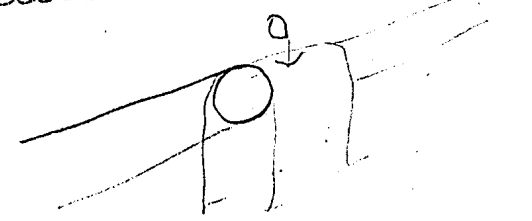
Hayes 44
Hanly 42

Evidently the $\frac{1}{32}$ wall is very little different from the $\frac{1}{16}$ wall, the probability is that walls do not act as diaphragm but simply conduct the wave

So thickness will not be of much advantage to us

Expt H

Same as G but piece sheet rubber



$\frac{1}{32}$ thick laid over pipe upon which water drops the 6" of length —

Hanks : 38

Hanky 40

not much gain here

Expt I.

Same as H, but rubber sheet bent over for drop to strike on Rubber $\frac{1}{4}$" thick

Hayes 42

Hanly 44

Expt J.

Same as I but instead of 1 layer $\frac{1}{4}$" rubber we use $\frac{1}{32}$ rubber sheet a wrap of around 8 times.

Hayes 44

Hanly 42

Strange

We let drop drop in pan
mat on tube tissue of we
can hear it.

Cant hear it on stethoscope

Expt K : tube plugged at dia end

Small $\frac{11}{32}$ wall tube blown on
end then 6" Rubber tubing

Water drops 6 inches
on suspended from
the thin tubing —

Hayes
Hardy

Cant hear
anything

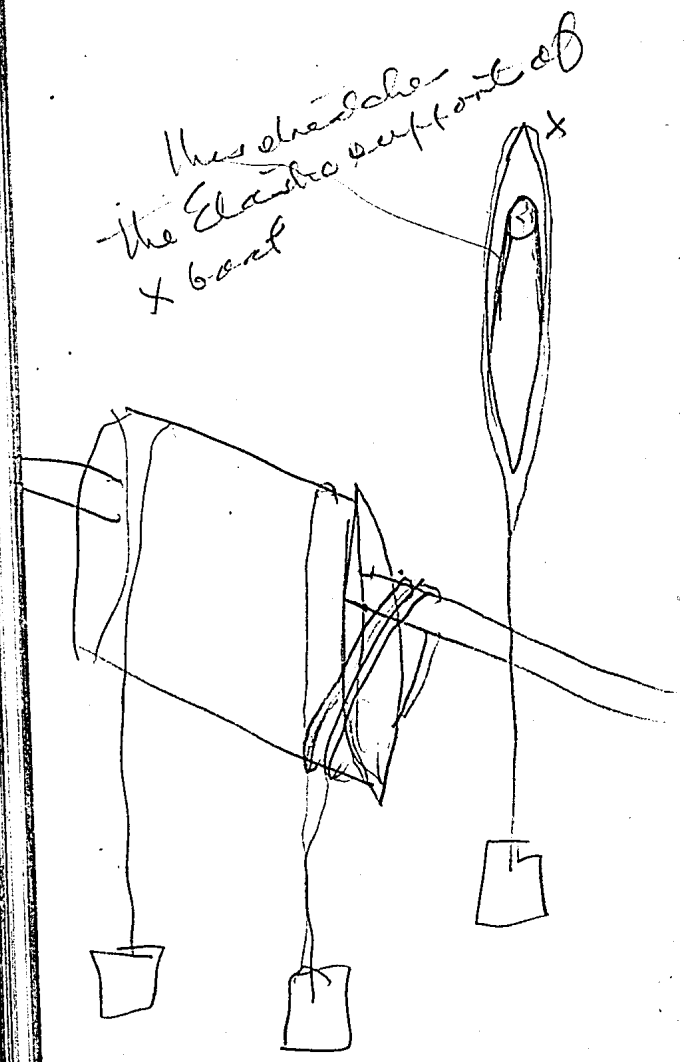
Expt L Same as K but water drops 6 ft instead of 6 inches –

Cant hear anything

Even throwing a Capfull of water on it only slight noise –

Expt M

Used 14 ft Rubber Tube 1/2" inside dia 1/16 wall water at 6 ft Very loud – acts as diaphr –



Expmt N

Same as Expt L

But 2 tubes of 1/4" Rubber holding up boat

Hayes 20

Hanley 12

Shows more rubber conducts sound better -

We use 2 tubes each side + now hang weights over boat to stretch the 2 support tubes at each end — 4 lbs of weight

Hayes 26

Hanley 26 -

Expt O

Same as N but water brought within 4" of boat + turned on full – gives about 1/4" solid stream –

Hayes 6

Hanley 8.

Stream is probably too continuous –

Burns now runs a pencil thru stream to interrupt it

Hayes 20 –

This seems very favorable + shows that a steady pouring of water not intermittent is a very quiet affair but if

$1\frac{1}{4}$ –

310) 1.250 – (400
240

200 –

Sudden or lets collinks its
noisy –

Took piece $\frac{1}{16}$ Soft Rubber
$1\frac{15}{16}$ wide Connected one end
to Scales & other End to a
Clamp clear across, its 1 inch
long.
1 lb pull on Scales elongated rubber to

1 lb	1 3/16 –		.186	64
2	1 1/4		250	62
3	1 5/16		312	
4	1 3/8		375	63
5	1 13/32		416	41
6	1 7/16		434	18
7		1 1/2	500	65
8	1 11/16		682	82
9	1 7/8		875	193

3 Stage -

Expt P

Old $\frac{1}{4}$" $\frac{1}{32}$ wall Tube
Phone at End - 6" rubber
tubing between phone & Tube
at dropping place
surrounded with a piece
of iron gas pipe 20 long
outside dia - $1\frac{11}{16}$
Walls ___ Thick, tube weighs 3 lb

a Diaphram at Each end of
iron pipe with hole for
1/2 pipe used - Outer Edge
rubber tied around iron pipe
by string - This support
iron pipe & 1/4" tube runs
nearly Central Water

All readings on
box Extra high
as compared to
Boat & Lab on
account of quiet
silence & absence
of outside noises

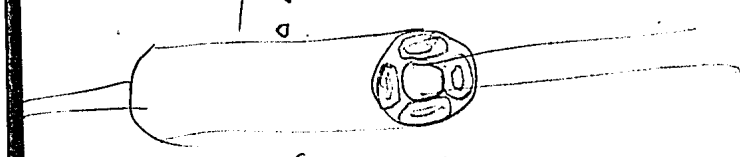
drops 6 feet in drops
on iron pipe — in cellar —
Hayes 56
Hanley 56 —

Dolphin rubber piece of inner
tube & it probably 3/32 —

Expt Q — change position of big pipe till central with pag
Dup of P but 2 lbs
hung weight at each
end, its about all it
will stand as one end
gets badly out of center
Hayes ~~48~~ 50
Hanley 48 —

Expt R Outside tube is now different
Brass 1 of $1\frac{1}{2}$ – inside dia $1\frac{5}{16}$
walls 3/32 – 18" long –

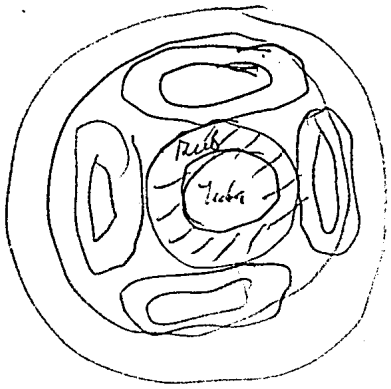
Same as Q but pipe
supported by 4 pieces
1/2 soft rubber tubing
1/2 long at each end



Water 6 ft drop –

Hayes 60 over –
Hardy 60 "

Dup with rubber tubing $\frac{1}{4}$"
long instead of 1/2 – no
well not had weight
of tube –



July 6 1918

We need remove rubber and hold the big tube central by hand not touching small tube,

Hayes
Hanley Nothing -

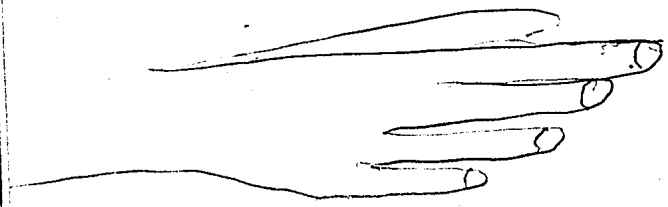
Expt 5

Reg ½ tube plugged, phone on end
Used 6" rubber pipe -

Large brass pipe does ½ pipe.
Ends supported on ½ tubing 3/16 wall
tubing pipe. 6 ft drop —
Length 19 3/4"

Pipe ~~2½~~ mean dia — ~~[illegible]~~
walls 5/32 Weight ~~8 lbs~~

Hayes 36 There is good probably
Hanley 28 due to larger diameter giving more elasticity



Expt T

Dup of S except the rubber tire Cork Hanley got in record

Cant hear anything both Jay

THIS IS FINE

Dup of T

But water drops 6 ft in a Continuous stream of about 1/8 dia strikes tube strongly spattering badly –

Hanley 54
Hayes 54

Continuous fine sound could till much about it until it was stopped & started many times –

Hawley says its not a noise that will interfere with boats

It was only when Burns stopped & stirred water that any noise could be noticed — when water running & one should sat down & listened to audion he would hear nothing but when intermitted then he would be aware of fine continuous roar

Listening direct is a shade louder as Hayes can just detect ring of the metal tube where water strikes, these

waves are too high pitch to get them the hearing individuals of the audion

Expt U - Drop of T

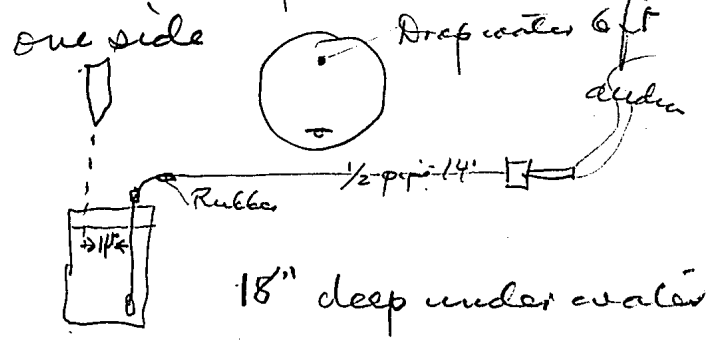
Jack whale decon stacing in Auto room - fitted tube on rubber sponge - dropped a solid column of water from a hose - inside dia of hose 3/4", 6 ft drop inside half of hose 6 foot drop -

Hayes heard 28 on box when column of water moved off 4 on

Hayes says he got a little metallic ring of the big tube He says sound wouldn't bother hearing boats in the least a great sound

Expt V to determine best diaphrm
& if smaller aperture can be
used than full face of diaphrm

We now fill a barrel with
water put on end of 1/2" tube
a Rec water diaphrm & place
it down in the water in bbl
—— inches from bottom to
one side



18" deep under water
6" from bottom, 6 ft drop
Scratched Mica 1 1/2/1000
This we will call No 1
Phone —

be extraordinarily rapid & would responds to high frequencies entirely inaudible to a large amplifier.

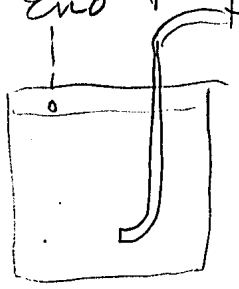
~~We now put plain pipe in No dia 1/4 hole & this plugged to see if any sounds comes outside of the pipe.~~
~~Hayes 18~~
~~Hanley 18.~~

We now put in No 2 Dia which is Rubber sheet rubber - very thin - ~~[illegible]~~ backed up by plate with 1/4" holes -
Hayes 18
Hanly 18

Bad - While the pneumatic support is nearly perfect there seems no way so far to use it under conditions we work

This is a very poor showing for Rubber, But probable if it was dropped in water so as to force rubber against plate it would be better,

We now put in a plain ¼ tube without diaphram End + Plugged, to see if we get much sound from outside the phone diaphram

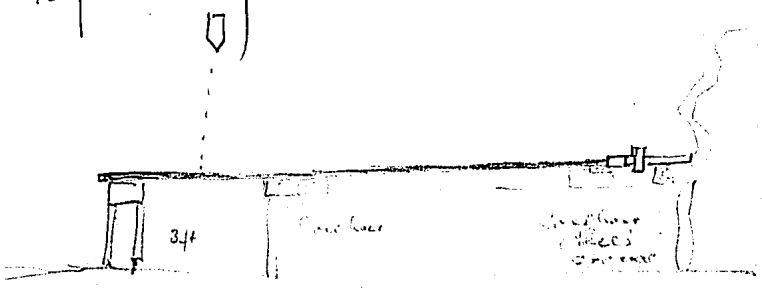


Hayes 20
Hanley 22

July 8th 1918

No 1 3 Stage

Solid ½ brass rod – phone connected to rod by 3" rubber tube, Water drop 6 ft. 10 ft along rod.



Hayes over 60

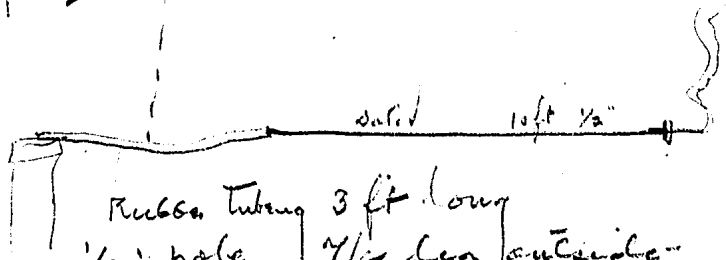
Hanley " "

We slipped piece rubber tubing over solid rod for water to strike on 1/16 walls

Just as loud ! !

We must find out if sound waves are longitudinal along solid rod or ~~[illegible]~~ waves travel along rod like a Chicken Carpet.

No 2 6ft



Rubber Tubing 3 ft long
½" hole 7/8 clear outside

This to find out how this rubber conducts

Hayes 34
Hardy 32

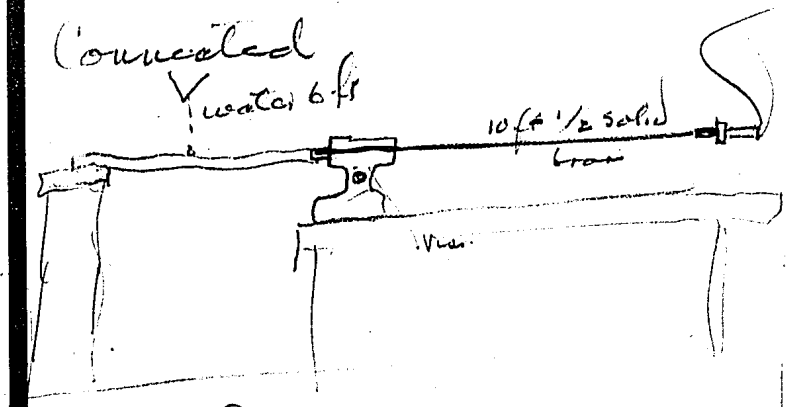
Very dull – would not be so bothersome as sweet one pipe.

No 3

Same as No 2 but

Rod clamped in Vise with rubber tube used in 2 expt

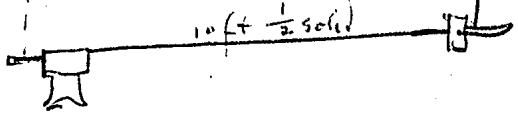
Concealed



Cant hear

No 4

Dup of #3 but
Rubber not used solid rod
Extends out from vise 2."
Water drops on overhang



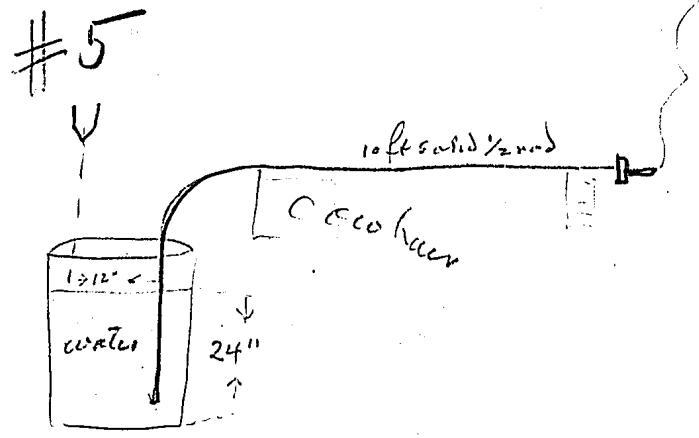
Drop hits solid tube 1" from Vise

Over 60 ?

Even louder than any

[redacted]

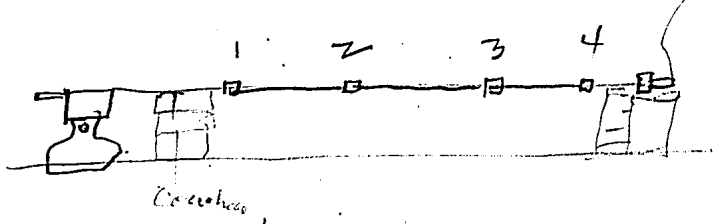
#5



Can't hear only whirling bubble bursts.

The Explanation for this is that the flow thru water is spread over large area & tubes don't get $\frac{1}{100}$ th of what it would get if drop shrunk down.

#6



Solid pipe ½" clamped in vise - overhang 1" drop strikes at end 3/4 from vise - #1, 2, 3, 4 are chunks of lead fastened to pipe to break up transverse waves from round traces this way

Hayes 48
Hanley 50

#7

Dup of #6 but a rider of lead sheet 3" wide 1/8 thick weight 1 lb – 2 feet from vise –

Hayes 48
Hanly 50 No impressions

Dom #6.

#8 Dup of #7 but 4 lead sliders – Each 2 ft apart along solid 1/2 brass rod –

Hayes 50
Hanly 52

Moved riders so spaced
irregularly along Rod —

Hayes 50
Hanley 50

Put Cocohair supports along
3 supports besides plane
on another Table —

Hayes 50
Hanley 52

Water dripped from rod to
Table, act was ahead so
water dont drop on Table.
as it might have dent waves
from Table

50
52 — Same as above

#9

We have use a lead pipe 1/2" hole 3/16 wall with plane on end. + plugged with Cork. Its held in Vise 2" overhang strikes about 1" from vise pipe seats on Cow hair.

Over 60

quite rancid - dull but (ac)

#10 We now Extend pipe outward so overhang 3" drops thicker 2" inches from Vise –

Just same Conditions as #9 –

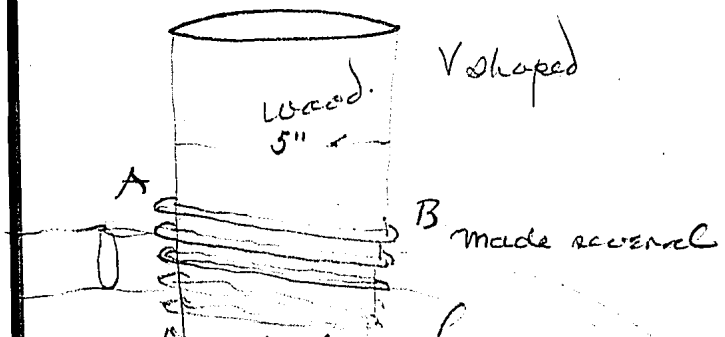
#11 – We put back 1/2" brass pipe 1/32 walls – 3 Cross bar supports – pipe in Vise 4" overhang – over this is 4" ~~pieces~~ big brass pipe with pneumatic Cork same as 1st used Water drops 6 ft – no sound over

#11 If Cork taken out we get

Hagen 50
Hardy 50

We now make a ~~[illegible]~~
about 1 ft. Drop off.
End of tube plugged
get nothing.

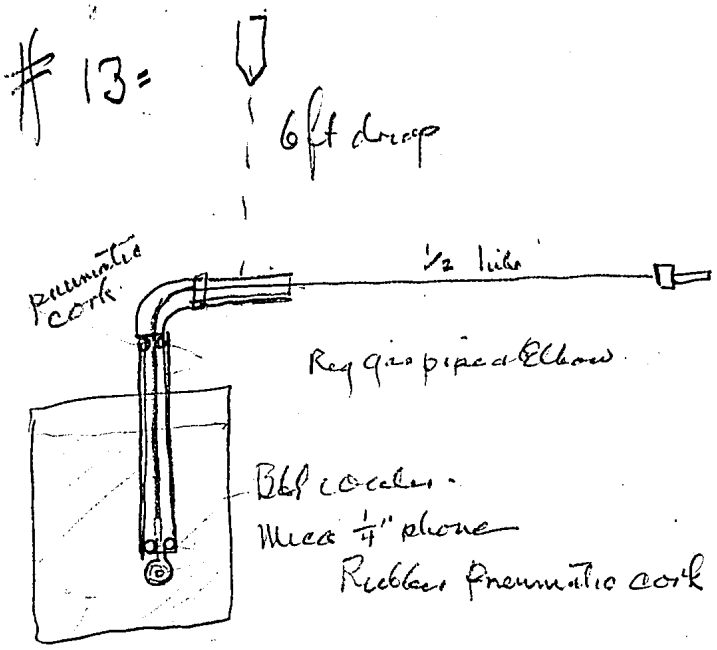
12



pieces ten set at angle
width of ledges $\frac{1}{4}$"
3/4 inch stream at A threw
stream drop B up -
no water run upon inside in
either case I placed on
plain board it did run up
1/2 inch at output end
This looks good, will mg
up tank & wheel on arm
10 knots threw water

Hayes had his hand over
dia Cant hear anything
Hearing Sound Came
from air -

13 =



Hayes
Hawley

More Than 60
A little water got in

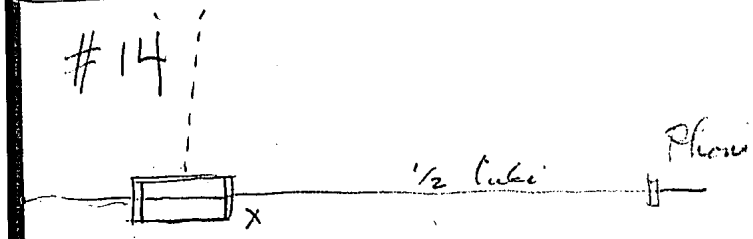
Pop of Diaphram holder nearly
touches pneumatic tire cork
Fired in air same position
Hayes - 34
Hawley 34

probably sound of
drop goes in air

13 by dropping on the surface of the water 12" away

Hanley 38 -
Hayes 36 -

14



X 4" long

plugged — X 2" Brass pipe

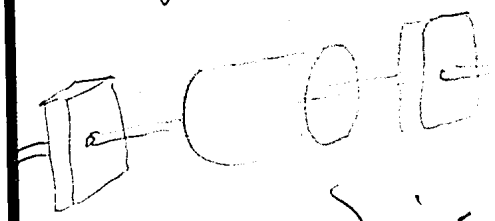
1/2" pipe passes thru Center Rod

Corks with holes in to support tube — Corks tight on 1/2" pipe but rather loose on big pipe

Hayes 54
Hanley 50

#15

Dup of 14 but instead of neg cork ends used rubber sponge at each end



These squeezed in ends of 2" brass tube -

Cant hear anything!

This is a better thing for me than the pneumatic as it packed enormously tighter. + is far wider -

#15 Continued – poured water on Ends to get water in sponge & tube –

Cant get anything on 3 stage.

Cant get any sound

6/900/112

July 8 1918

#16 — of 15

Duplicate, but use iron pipe 12" long 1½ inside diameter, managed to squeeze the rubber sponge in with ½ pipe passing thru Cinder. Went in very hard —

Hayes 44 — 10 pm & very quiet
Hanly 46 — 6 ft drop

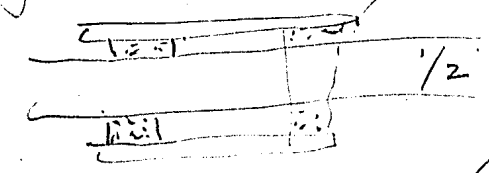
This is packed far beyond what we shall need — 100 grams per inch is all that is necessary I think It is to put a very quiet —

#17

1" inside brass pipe, 1/16 wall

8" long put in 1/4" lodi

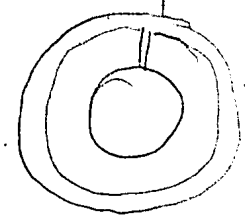
pad rubber each end 1/2 wide



Drop 6 ft -

Hayes 50

Hardy 50



Wont in quite hard.

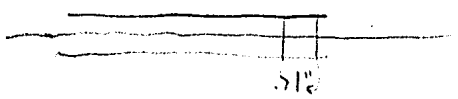
This wont be good as sponge

18

We now use iron pipe 20" long 1½ inside – using two thickness of Lodi rubber – 6 ft drop pipe in loose – sags only a little – width or length of cork ½

Hayes – 40
Hanley 42

We now make cork 1" long



1st load only ½ long

Hayes 40
Hanley 42 Same

(to be finally tight now)

#18 Continued

102 now make length of Rubber 3" - so weight compression it very much less -

Hayes. 54
Hanley. 52

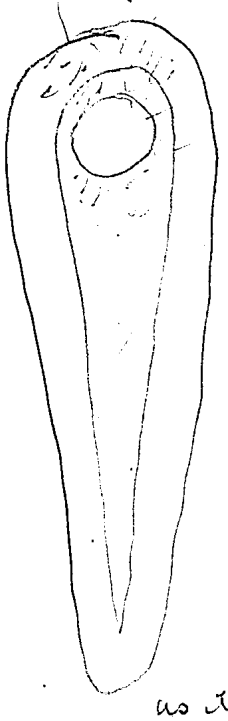
Neiosheme

#19

Soft rubber cylinder

Eft drop

½ Eft drop



1/3" tube

1/32 sheet brass

as its narrow some droplets 1/32 dia spatter on pipe

Hayes 40

Hanley 40

#20 . Dup of 19 Except added wt of lead

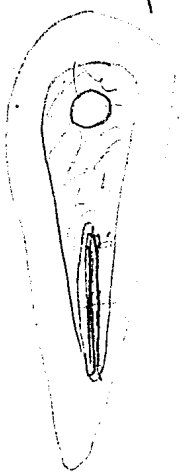
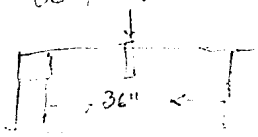


plate of lead wt 1 lb –



Hayes 34
Hanly 34

We now support lines 2 ft centers

Hanly 40
Hayes 40

Its not opatter as shielded
lube from Opatter –

We now move req pipe to one side & lay another pipe ½ × 14 near it 1½" from it & let water strike direct on dead pipe to see if sound comes thru air —

Hayes 48

We need separate dead pipe 6" away & drop on it —
both pipes are on same Cowhair —

Hayes 26
Hanly 28

We now lay live pipe on Rubber sponges & drop on dead pipe —

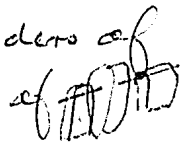
Nothing —
this shows shock went thru cowhair supports

#21. We now use only
lower tube and drop on

but whole thing phone
still supported on
sponges of nucleoi -

Hayes 46
Henry 50

We now put riders of
lead each side of



1" from

Lead 2 lbs Each, bends
pipe considerably

Hayes 46 Metallic ring gone
H 50 Little duller

#22

We now fix phone thus

H+H, 46-50.

We now (dep of 22) lay a rider over

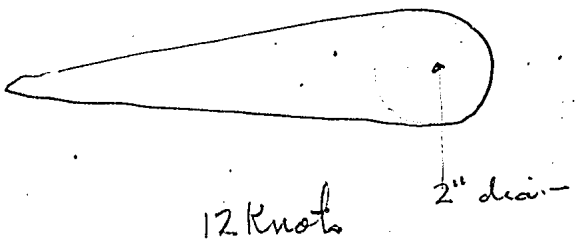
Water dropping on rider to see if Mice stop it

Hear nothing

This shows value of mice possibly lack of Elastic in hem

Data -

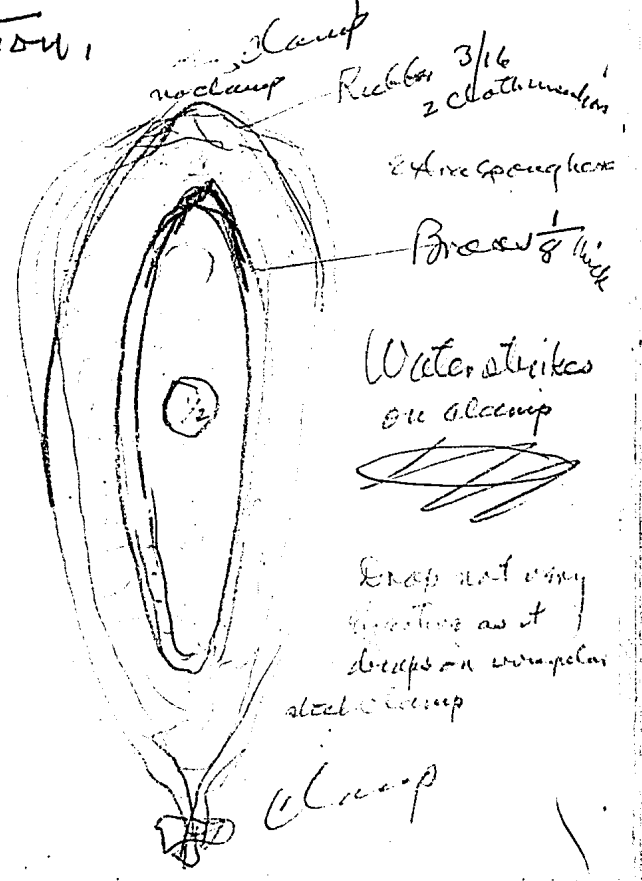
a plate having 1 ft total surface immersed & pulled along in water gives a torque or pull back at 12 Knots of 1.4 lbs per sqr foot.



pressure on head is 5.32 lbs per inch of heighth but when under water so back end or lodge compressed then its only skind friction

See page 1 Kundson

#23. We now try another section.

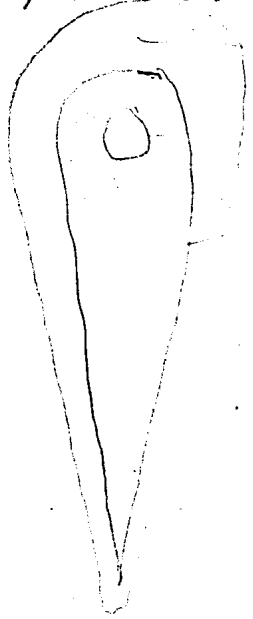


Hayes Handy Walking

This shape is nearly form we want

#24-

Sheet iron -



longer element of sponge at keel

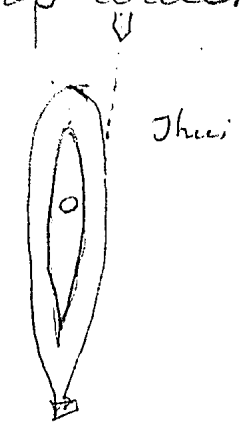
sheet iron thin

Hayes 18.
Hanley 16.

Very dull hard to tear -

#25

Same as 23
but we drop water on
angle



Hott Nathing —

#26

Drop 25

↓

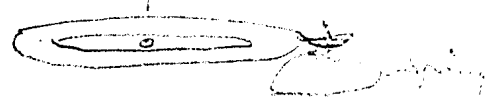
Drop water flow

Hayes 8
Hensley 8

Very dull & hard to hear & then only in absolute quietness –

Drop right over pipe –

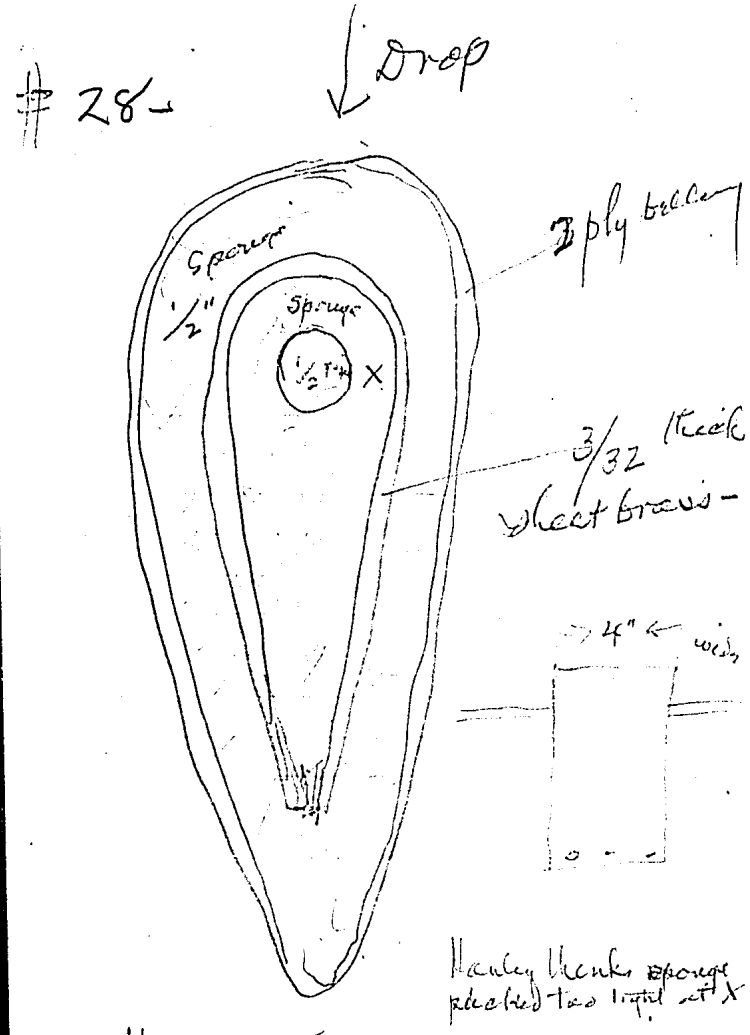
#27 –



Hayes H 10

Had to listen long while to get it very very dull

28 -



Hanley 28
Hanley 26

Very dull sound.
Very hard to hear

Page X -

Water thrown against carrier at + above water edge is not compensated for by wedge shape of carrier, hence if the blow is spread over 4 inches the blow will be approx 20 lbs against the head of 2" circle

X

as this is already we must have outer sponge section under a compression of 5 lbs per inch of height of carrier. X

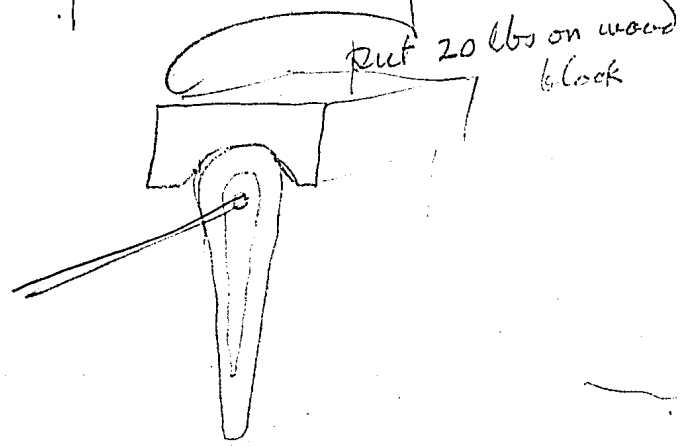
Moment compensated

a wave breaking against sides 10" wide of carrier moving 10 ft seconds gives total press of 755 lbs

#28 (Continued)

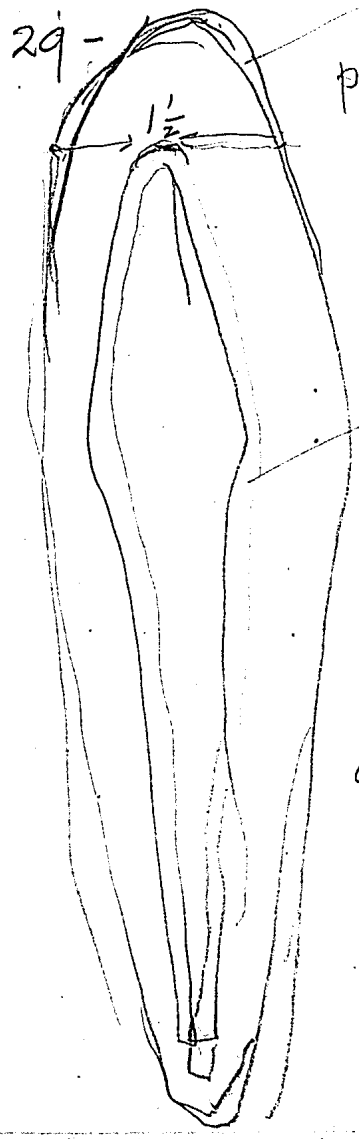
We now packed sponge at X i.e. little loose -

get Nothing =



This doesn't compress over $\frac{1}{32}$ with 20 lbs - but its probably not a fair test as wooden construction.

29 -



2 ply

packed more on End X -

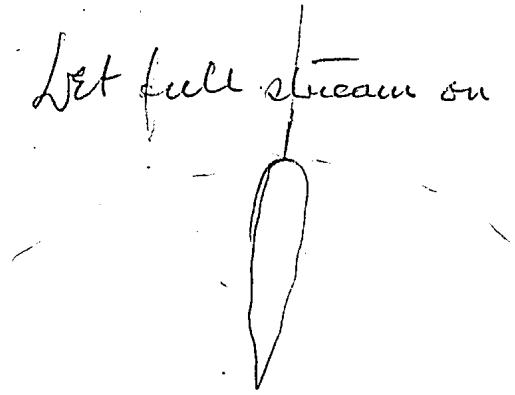
This is practically but can be made more pointed yet

full ⅛ Grain

Cant get any sound left drop on Edge

#29 Continued

Let full stream on top



Spatters 6 ft away

Hanley 20

Hayes 20

Very dull sound

Strong sound all thru room —

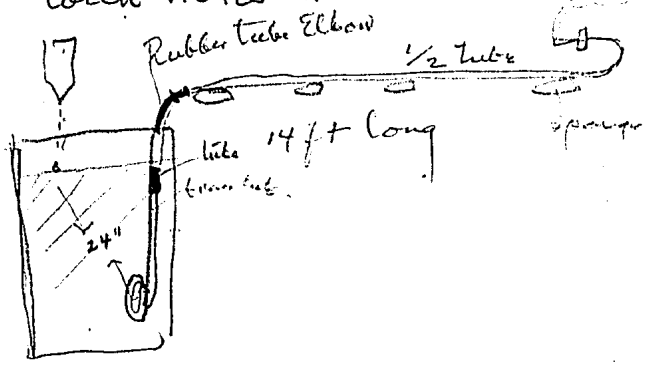
probably noise in room -

probably outside noise varied -

30

Experiments with Receiver -

def thickness of mica 1½ 1 + ½/1000 laping on plates with holes in -



1 3/16 dia 1½/1000 Drop 1"

Cant hear -

3" drop get 12 on box but very weak

9 pm - some noise around

We now drop 6". hear it sometimes around 20 but only sometimes -

#30 Cont'd

We now drop at 1 ft.

Hayes 48

Hanley 50

Window in the listening room was open — + big room

We put it back to drop 9" —

We close windows in big room + in listening room —

Hayes 46

Hanley 46 —

By closing windows it got very quiet,

We now put it back to 6"

Hayes. Can't hear steady drop, only bubbles +

Hanley

#30 Continued

We now put it at 8" water drop.

Hayes 46
Hanley 44.

8" Drop

2 mch diaphrm — 1 1/2/1000 mica

38 1/4" Holes

Hayes
Hanley OVER 60

When the boys said it was over 60 on boxes I couldnt hear a sound at Zero on boxes showing conclusively that on boat when I could hear to 6 + very loud at Zero. They couldnt hear to 50 @ 55 - The boat noises probably made their ears several times less sensitive Hence Value of BOOTH.

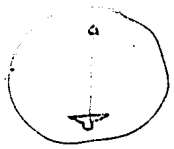
#30 Continued

We drop now at 6"

Hayes 54

Hanley 56.

In these tests diaphragms face the drop



The gain by big dia is scarcely of any value, in fact there is no gain although it was in proportion to area it would be 3 time louder

July 19th 1918

#30 Continued —

We now put back the 1 3/16 Standard Record but instead of 1 1/2/1000 mica we use 1/2/1000 mica —

6" water drop —

Hayes 48
Hanley 48 —

No advantage in 1/2/1000 thick dia over 1 1/2/1000

There is an Error running all thru #30 Experiments

Think these Expts
Satisfactory

#30 Continued

as we had a rubber tube
joint on the tube + this
joint was down in the
water + acted as a
diaphm -

We now put in back in
bbl - plug the end where
diaphgm is + depend
on the rubber tubing
joint to act as a
diaphm -

Cant hear anything

		½
3000	4.3 inches	2.15
2000	6.42	3.21
1500	8.6	4.3
1000	12.96	6.48
800	16.2	8.1
500	26	13.
300	43	21.5
100	129"	64.5

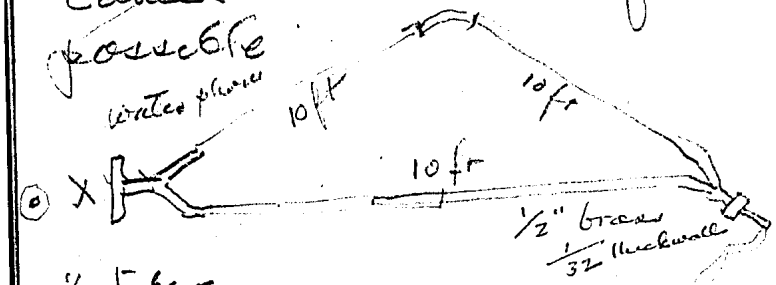
Later

Nearly all the Experiments following this for neutralization were faulty as we later found that the tables conducted the sound to phone & when tables small acted as sounding boards & our results due to jar small supports & sponges stop it

Experiments. July 11 1918

No 1 Expt

to obtain neutralization of sound from observers screw propeller & boat noises that enter water phone & to cancel them out as far as possible



½ tubes –

water drops on iron 2 ft away from diaphram –

Diaphram X is 17 Hole plate 1½ Mica Water Receiver

1st	48 –
base 1 ft. longer over 60	
base as 1st	– 48.
½" longer than at 1st	46
1" "	44
1½	42
2	42
2½	42
3"	44

OVER

No 1 Expt Continued

$3\frac{1}{2}$	48
4	50
$4\frac{1}{2}$	50
5	48
$5\frac{1}{2}$	46.
6.	50
7"	44
8"	50.
9"	50
10"	52
11	50
12.	52

note changed to inches

We now go back to Zero point and take a reading then go in by 2" increments

Zero start. 50

1 Expt.

2" in —	46.
4 —	46
6 —	48
8.	48

Don't seem to be much neutralizing — but the sound going thru long side arrives at phone louder than short pipe hence this interference.

We disconnect short pipe & let sound go thru it only to get value on box

Hayes gets 44 -

We now disconnect long side & put in short side

Hayes gets. 50. -

We now take out diaphragm plug hole get 44 $ $

This shows its going thru
pipe or table when the
diaphm end was screwed by
wood clamps to Long Table
it acting as sounding board
The speaker voice equally heard
in all parts of the room —
We need disconnect from
table, place all on sponges
diaphm hole plugged
get 44 Strange
We had a cork, went in 3/4
We need substitute a solid rubber
cork — 44 ?

We now disconnect phone Entirely & plug the end of a tube 4" long Expanding outwardly to put soft rubber tubing on

Get nothing

We connect long 1/2" brass tube 10 ft BUT LEAVE CORK IN PHONE 4" Tube

Can just hear when 60 x 20 zero go to 2 feet,

Thus shows it comes thru air in pipe —

The tube is connected to the diaphrm holder by rubber tubing at diaphrm — this may act as a diaphrm — disconnected it & plugged end of tube.

Get 44 — The $\frac{1}{32}$ walled tube must act as a diaphrm —

I think the water phone not good for this not enough power in air waves

WE NOW substitute Reg 1 3/16 mica not backed up by 17 Hole plate.

This dia on end of 10 ft tube

Hagen gets only 56 - but phone is connected to a Walter Miller Valve

We now connect direct to tube by rubber - butts within 1/16 - OVER 60 !

We now put in 10 ft tube 1/2 hole 3/32" wall — plug then end + see if thick wall ~~[illegible]~~ acts like 1/32 wall —

Get Nothing

Showing we can't use thick wall tubes like 1/32 on absorb

We now attach the diaphrm -
(not backed up by 17 hole plate)

Above 60 =

Hereafter consider no tube of 1/2 inch inside that has cost less than 1/8 while 3/32 tube 10 ft didnt act to give a sound due to water drops falling on a board from heighth of 6 ft.
board 7/8 - thick 3" wide laying west edge of water 6 ft - phone end 2 ft from point where

All this later on may be incorrect a we have apparently proved that the table on which phone rested is a sounding board + that phone to aid a defective ear

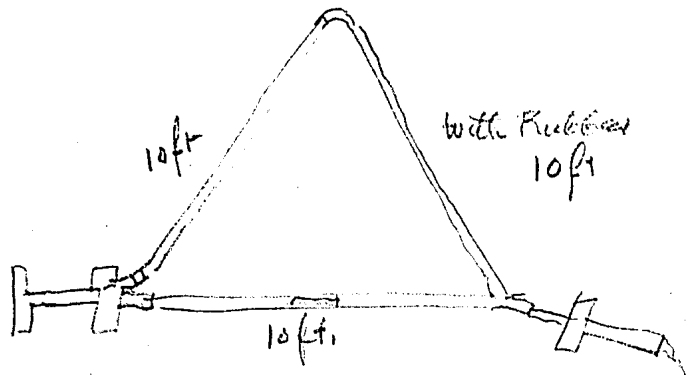
With good phone + on sponges + water end plugged we get nothing -

We dont get anything when 1/32 tube used

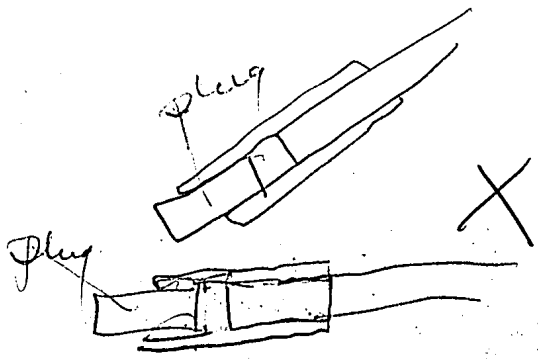
water drops, This volume of sound which is clearly heard all over the big garage room is insufficient to cause walls of tube 10 ft long 3/32 thick to act as diaphr. To cause air wave to travel in 10 ft tube to Bellphone + 3 stage and when other end plugged might so act if the sound was several times louder like on a boat + therefore 1/8" walls is safest to use when bore is 1/2" — See Note

not so

We now make a new equalizer



1/2 bore brass tube 3/32 walls
rubber connectors as short as
3 stage, water drops 6ft
on 7/8 board 3 wide laid
across top of water bbl.
Diaphm m phone - get
Hayes - 50 on 60x



We now plug end of tube at diaphragm —

Hayes gets 32

When we should get nothing

We now support all the 3 tubes on sponges

Hayes gets 50 on Box ?

We take the 2 tubes at Diaphrm end off Mullers Valve + plug Each separately ~~but~~ put plug in the rubber connectors

Hayes gets 34 but later found 2 holes in cork

Put in solid corks (Fuegos)
Hayes gets 32

We now remove rubber tube
Connectors at the 2 pipe ends
at dia & put ~~on~~ corks
directly into End of Green
pipes 30

We take out all the Sponges
Except where phone rests
Hayes gets 30.

We now only use the 10 ft
tube plugged at other End
Connected phone ~~& extra~~
took off Y
~~Connected Clamp [illegible]~~
Hayes gets 30

It laid on table we now put sponges under -

Hayes-gets 30

This dont drop what we got before with the 3/32 pipe which was 2. However present pipe is split & has small piece 1/32 wall 1/16 inserted but not seen

We not use continuous 3/32 wall pipe as in original experiment,

Hayes-gets 30

Very Strange

We disconnect phone + plug it to see what we get,
Hayes gets 24

We take off Ear phone + expose only the Magnets phone
Entirely disconnected from everything but rests on sponge
Hayes gets Nothing

Note = Until we can get phone itself when plugged to give no sound in 3 stage

When 18" from water
drop board its a defective
instrument & will
throw us out We now
try to get it sound
proof when plugged
With a better head for
pouncing tube Hayes
gets 8 on box

We now advance phone
10 ft toward water
drop board - now 18"
from it — Hayes gets 10
Very strange law of sound * dont work here

* Sound not so far transmitted
by long table,

Phone held up by Hanley holding Cord –
Hayes gets nothing –

We put phone back to old place 10 ft on its table place on stanchions + move long table 4 or 5 ft away + take away pipes

Hayes gets NOTHING

It was the table that did the big – will remove it +

use seperate small supports + bring phone up to within 18" of dropping –
now done

Hayes gets Nothing

It was the long table

Under these conditions we lay a 3/32 tube 10 ft long connecting the front table with the phone table –

Hayes gets nothing

This appears to show tube dont conduct from one table to the other – tube lays on wood of table

We now connect this tube to phone = its plugged at water drop end 4–18" from drop + unsupported in middle between tables,

Hayes get 42

this with rubber cork

We substitute Reg Cork Cork

Hayes gets 42

We now lay the water end of tube on a sponge support.

Hayes gets. 42

We now put 2 sponges for support.

Hayes gets Nothing

We remove the sponges from water end of tube.

Hayes gets Nothing

We change support of phone by sponges in different ways Also lay on table, -

Now on table 34 on bot

Now pipe held by sponge phone over Column — book gives nothing

See Book
2